

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF THE GEOPHYSICAL SCIENCES

Semiannual Status Report  
1 October 1964 through 31 March 1965

under

NASA Grant NsG-333 Research

METEOROLOGICAL INTERPRETATION  
OF  
SATELLITE RADIATION DATA

**UNPUBLISHED PRELIMINARY DATA**

Sponsored by  
National Aeronautics and Space Administration  
Washington 25, D. C.

FACILITY FORM 602  
N65-84171  
(ACCESSION NUMBER)  
4  
(PAGES)  
OK 62531  
(NASA CR OR TMX OR AD NUMBER)

(THRU)  
None  
(CODE)  
(CATEGORY)

## SEMIANNUAL REPORT

During the report period the following investigations were performed.

### 1. Resolution of the Nimbus High Resolution Infrared Radiometer.

For the purpose of evaluating the resolution of the High Resolution Infrared Radiometer (HRIR) flown on board the Nimbus I meteorological satellite, three cloud-free regions in the western United States - the Grand Canyon, Death Valley, and Sierra Nevada - were selected. Enlarged HRIR pictures and the analog frequency traces of the scan lines in the pictures were examined in an attempt to investigate the types of noise superimposed upon the signals. Two types of noise which appear in periodic and oscillatory fashions were found. The latter can be eliminated by taking running-mean values at one-degree scan angle intervals. The equivalent blackbody temperatures thus obtained were analyzed over these three regions, leading to the determination of the apparent temperature lapse rate inside the Grand Canyon atmosphere and of the temperature of Lake Tahoe and other lakes in the Sierra Nevada. Death Valley was found to be about 10C warmer than the surrounding desert area 5000 feet high. An attempt was also made to produce an HRIR picture with isoneph contours similar to the iso-echo presentation of radar pictures.

The research has been summarized in SMRP Research Paper #40 issued in February 1965 and has been submitted to the Journal of Applied Meteorology. 100% NASA.

### 2. A Program for Computer Gridding of Satellite Photographs for Meso-scale Research.

A computer program is described which performs the coordinate transformations used in Fujita's graphical method for gridding TIROS photographs. Output is a matrix of picture coordinates of latitude-longitude intersections on the earth to be plotted on a distortion-free grid.

The results are described in SMRP Research Paper #42 issued in March 1965. 50% NASA, 50% WBG-6.

### 3. Relationship between TIROS Radiometer, Aircraft Radiometer and Soil Temperature Measurements.

An attempt was made to examine the problem of relating satellite measured temperatures to the equivalent blackbody temperatures of the earth's surface. Also, an estimate was obtained on the equivalent blackbody cloud cover of cirroform type clouds for one TIROS VII orbit. In connection with the above, Colorado State University conducted a series of experiments whereby soil temperatures were obtained for the Pawnee National Grassland

area in Colorado. In addition, the equivalent blackbody temperatures for the same region were measured from heights ranging between 5,000 and 19,000 feet by a radiometer mounted on the underside of a Cessna 180 aircraft. The aircraft flights and soil temperature measurements were timed to coincide with the overpass of TIROS VII.

The results of this study are described in a SMRP Research Paper to be issued soon.  
100% NASA.

#### 4. A Cold Front over South America as Revealed by TIROS Radiation Data.

Three different meteorological patterns frequently found over South America have been studied with the aid of TIROS III radiation data. Orbit Nos. 133 R/O 134 and 147 R/O 148 for 21 and 22 July 1961, respectively, were analyzed for patterns of solar reflected energy (Channel 3) and of the infrared flux (Channel 2). These patterns were related to the presence of stratus or stratocumulus over the water and along the coast of Peru and Chile, cumulus development over the eastern slopes of the Andes Mountains in Peru, and a frontal system over the South Atlantic.

The study is completed and results will be described in a report to be issued in April 1965. 25% NASA, 75% WBG-6.

#### 5. Scattered and Reflected Solar Energy Obtained by TIROS Radiometers as a Function of the Backscattering Angles.

Radiation data from four orbits of TIROS IV have been used to show the anisotropy in reflected and backscattered radiation from the earth to the satellite. The amount of energy received at the floor and wall sensors show reasonable agreement in most areas. The values are dependent on the backscattering angle as well as the reflecting surface. There are indications that, in the cases studied, the maximum values occur when the backscattering angle is around  $10^{\circ}$  to  $25^{\circ}$ , a secondary maximum between  $100^{\circ}$  and  $140^{\circ}$ , and a minimum value around  $70^{\circ}$  to  $85^{\circ}$ .

It is found that further study will be necessary and the results will be reported on during the next report period. 50% NASA, 50% WBG-6.

#### 6. Death Valley Experiment.

Temperature measurements by Nimbus I revealed strong gradients and high values for the Death Valley region in California. Subsequently, a series of measurements were made by the University of Colorado to determine variations in thermal emissivity of the widely differing soil types found throughout the valley floor and adjacent higher terrain. A network

of instrument sites was also established at 1000-foot intervals from a nearby mountain peak to the valley floor in order to obtain a 24-hour temperature profile at varying elevations above sea level. In addition, infrared radiation measurements were recorded by hand-carried and airborne radiometers during the temperature study. A preliminary report will be prepared containing several photographs of the experiment and terrain along with a discussion related to Nimbus I observation of the area.

100% NASA.